California Environmental Protection Agency Air Resources Board

PROCEDURE FOR THE ANALYSIS OF AUTOMOTIVE EXHAUST FOR METHANOL AND ETHANOL

Standard Operating Procedure No. MLD 101
Revision 2.1

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1 Introduction

- 1.1 This document describes a method of analyzing automotive exhaust for methanol and ethanol in the range of 1.5 to 1200 micrograms (µg) per 15 milliliter (mL) of solution.
- 1.2 This procedure is based on a method developed by the U.S. Environmental Protection Agency (EPA, Ref. 9.1) which involves flowing diluted engine exhaust through deionized water contained in glass impingers and analyzing this solution by gas chromatography.
- 1.3 This SOP is based on Method 1001 of the California Non-methane Organic Gas Test Procedures (Ref. 2, Part C).
- 1.4 Lower alcohol concentrations may be analyzed by increasing the volume of exhaust sampled.
- 1.5 Higher concentrations may be determined by quantitatively diluting the aqueous impinger solution with deionized water or extending the calibration curve to include higher standard concentrations.

2 Method Summary

- 2.1 For routine motor vehicle exhaust testing, the vehicle is tested according to the Federal Test Procedure (FTP, Ref. 9.3), using a dynamometer (dyno) and constant volume sampler (CVS) to dilute the exhaust for sampling.
- 2.2 Samples are also received from CVS testing using non-FTP driving cycles, Sealed Housing Evaporative Determinations (SHEDs, Ref. 9.3), gas standard cylinders or canisters, and alcohol-containing samples from other miscellaneous sources.
- 2.3 Two impingers, each containing 15 mL deionized water, are used to collect samples for each phase of the CVS test.
- 2.3.1 For each phase, the two impingers are connected in series: the one closest to the source is designated as the primary impinger and the one farthest from the source the back-up impinger.
- 2.4 Upon completion of the CVS test, the impinger solutions are analyzed by gas chromatography.

3 Interferences and Limitations

- 3.1 An interferent is any component present in the sample with a retention time similar to that of any target alcohols described in this method. To reduce interference error, proof of chemical identity may require periodic confirmations using an alternate method or instrumentation, e.g., (GC/FTIR).
- 3.2 The concentration of the alcohols in the range of interest is stable for up to six days as long as the samples are sealed and refrigerated at a temperature below 40°C. Therefore, samples must be kept refrigerated and be analyzed within six days of sampling.
- 3.3 Recovery tests have been limited, due to the instability and resulting limited availability of gas phase methanol and ethanol standards.
- 3.4 Quality control of the sampling procedure is overseen by MSCD or MSOD.

4 Instrumentation and Apparatus

- 4.1 The analytical system is comprised of the following:
- 4.1.1 Gas chromatograph (GC), Varian model 3400 or equivalent, equipped with DB-Wax Megabore column [30 meters, 0.53 millimeters (mm) internal diameter (ID), 1 micron (μ) film thickness] and flame ionization detector (FID).
- 4.1.2 Autosampler, Varian model 8200 or equivalent.
- 4.1.3 Varian Star version 5.3 (or similar) data system.

5 Reagents and Materials

- 5.1 Methanol, 99.9%, HPLC grade, EM Science or equivalent.
- 5.2 Ethanol, absolute.
- 5.3 ASTM Type I purified water, HPLC grade, Burdick and Jackson or equivalent, or ASTM Type II deionized water,
- 5.4 Stock solutions are prepared by diluting 1.00 g each of methanol and ethanol to 100.0 mL with high purity water. This standard is prepared gravimetrically and the concentration expressed in µg /mL.

- 5.4.1 Working (calibration) standards are prepared by successive dilutions (v/v) of the stock solution(s). The current calibration standard is 3.0 µg /mL, though higher concentration standards should be used for high concentration samples. Figure 1 illustrates typical chromatograms of a methanol/ethanol standard.
- 5.4.2 A control standard is also prepared by successive dilutions of a stock solution different from that of the calibration standard. The concentration should be approximately that of the samples, typically 1.5 µg /mL.
- 5.4.3 Stock solutions are prepared at least every six months.
- 5.4.4 Calibration and control standards are prepared at least every six days.
- 5.4.5 All standards should be refrigerated at a temperature below 40°F during storage.
- 5.5 If other alcohols are found in the exhaust, standards containing these additional compounds are prepared, as above.

6 Procedure

- 6.1 Each of nine graduated impingers (Ref. 9.2) is filled with 15 mL of deionized water.
- 6.2 For a normal FTP test, eight impingers are divided into four sets of two; a ninth is used as a trip blank. Each set is connected in series and placed in an ice bath. Dilute exhaust is drawn from the CVS through each of the four pairs of impingers during phases 1, 2, 3 and the background, respectively.
- 6.3 After sampling, the solution contained in each impinger is transferred to a storage vial and capped.
- 6.3.1 If the sample cannot be transferred immediately following the test, the impingers are refrigerated at a temperature below 40°F until the solution is transferred to the storage vial.
- 6.3.2 Samples shall be refrigerated at a temperature below 40°F if immediate analysis is not feasible or if reanalysis at a later date may be required.
- 6.4 Prior to analysis, an aliquot of 1 to 2 mL of each sample is transferred to a 2-mL autosampler vial.
- 6.5 The vials are allowed to warm to room temperature prior to analysis.

6.6 A 1.0 microliter aliquot of each unmodified sample is injected via autosampler into a gas chromatograph, configured to operate under the following nominal conditions:

Column	DB-wax, 30 m, 0.53 mm ID, 1.0 µ film thickness
Carrier gas	helium at 5 mL/minute (mL/min)
Make-up gas	nitrogen at 25 mL/min
Detector	FID, hydrogen at 30 mL/min, air at 300 mL/min; 275°C
Injector	packed column injector with megabore adapter insert; on-column injection; 150°C
Temperature	50°C (hold 1 min), 50°C to 65°C (5°C/min, hold 0.5 min), 65°C to 110°C (15°C/min), 110°C (hold 3.5 min)
Data System	Varian Star 5.3 or later

- 6.7 One calibration standard, one control standard and one water blank are analyzed daily at the beginning of each set of samples.
- 6.8 A duplicate analysis is performed on one of every ten samples, or at least once per day.
- 6.9 The control standard is repeated approximately every ten samples and again after the last sample is run.
- 6.10 The above procedure may be modified for analysis of higher alcohols by increasing the final temperature and adjusting the temperature ramping to achieve good separation of the desired components. In addition, a less polar impinger solution would be required to capture alcohols above C₅.

7 Calculations

7.1 The concentration of each alcohol is determined by comparing the sample peak area with that of an external standard:

Concentration (µg/mL)_{sample}= Peak Area_{sample} x Response Factor

where the response factor (RF) is calculated during the calibration by:

7.1.1 This concentration is then used to calculate the total amount of methanol and ethanol in each impinger:

Mass (μ g) = Concentration (μ g/mL) x 15 mL

8 Quality Control

- 8.1 A deionized water blank is analyzed daily to check the water used for sampling and the analytical system for contamination.
- 8.1.1 If the blank shows a peak greater than the limit of detection (LOD) in the region of interest, the blank analysis is repeated.
- 8.1.2 If the peak area is consistent, the blank value is subtracted from the samples. (Note: The standards should be made with water containing no alcohol.)
- 8.1.3 If the peak area is not consistent, the source of the contamination must be investigated.
- 8.2 A trip blank is also analyzed for every emission test
- 8.2.1 If the blank shows a peak greater than the limit of detection (LOD) in the region of interest, the blank value is subtracted from the samples.
- 8.3 One run of the calibration standard(s) is performed per day to generate the response factors needed for quantifying sample analyses.
- 8.3 The quality control standard is analyzed at the beginning of each set of samples, and repeated approximately every ten samples and after the last sample.

- 8.3.1 A quality control chart is maintained for each alcohol in the control standard. The control charts, used on a daily basis, establish that the method is "in-control". The following describes how a typical control chart is constructed:
 - (1) Obtain at least 20 daily control standard results;
 - (2) Calculate the control standard mean concentration and standard deviation for the target alcohol; and
 - (3) Create a control chart for the target alcohol by placing the dates on the x-axis and the concentrations on the y-axis. Establish upper and lower warning limits at either two standard deviations (2Φ) or 5 percent, whichever is greater, above and below the average concentration. Establish upper and lower control limits at three standard deviations (3Φ) or 5 percent, whichever is greater, above and below the average concentration.
- 8.3.2 Measurements of both methanol and ethanol must be within the control limits ("incontrol") before sample analysis may proceed. Values which exceed the control limit are considered to be "out of control". If all measurements on two consecutive days exceed the warning limit, the second day's analysis is also considered to be out of control. If either methanol or ethanol is out of control, it may be necessary to inspect and repair the GC, and rerun the calibration and/or control standards until the control standard criteria are met. When the QC criteria are met, sample analysis may continue. Figure 2 demonstrates a typical QC chart.
- 8.4 A duplicate analysis of one sample is performed at least once per day. The relative percent difference (RPD) is calculated for each duplicate run:

RPD (%) = <u>Difference between duplicate and original measurements X 100</u>
Average of duplicate and original measurements

For each target alcohol, the allowable RPD depends on the average concentration of the duplicate runs, as shown in the following table (Ref. 9.1):

Average Meas	<u>surement</u>	for Duplicate	<u> Allowable RPD (%)</u>
1 to 10	tim	nes LOD	100
10 to 20	"	II .	30
20 to 50	11	II	20
Greater than	50 "	II	15

The results from duplicate analysis must meet the criteria above for all target alcohols. If the criteria are not met, the sample must be rerun. If the criteria are still not met, all sample results for the day from this instrument must be invalidated and the samples reanalyzed. Figure 3 shows a typical duplicate sample report.

- 8.5 A multipoint calibration to confirm instrument linearity is performed for methanol and ethanol. It is done for new instruments, after making instrument modifications which can affect linearity, and at least every six months. The multipoint consists of at least five concentrations, each above the current LOD, approximately evenly distributed over the range of expected sample concentrations. Each concentration is measured at least twice. A linear regression analysis is performed using concentration and area counts to determine the regression correlation coefficient (r). The r must be greater than 0.995 to be considered sufficiently linear to ensure the accuracy of the daily one-point calibration. Figure 4 illustrates a typical multipoint calibration.
- 8.6 The LOD for methanol and ethanol must be determined for new instruments, after making modifications which can affect linearity and/or sensitivity and at least every six months. To make the calculations, it is necessary to perform a multipoint calibration consisting of at least four "low" concentration levels, each above the expected LOD. The LOD is calculated using the following equation:

$$LOD (ppbC) = |b| + (t \times s)$$
m

where

|b| = the absolute value of the y-intercept, area counts

 $m = the slope of the linear regression, area counts/(<math>\mu g / mL$)

s = the standard deviation of at least five measurements of the lowest concentration standard, area counts

t = the t-factor for 99 percent confidence for a one-sided normal (Gaussian) distribution, dimensionless

The number of degrees of freedom is equal to the number of runs (n) of the lowest concentration standard, minus one. An abbreviated t-table is (Ref.9.1):

Degrees of Freedom (n-1)	t-values
4	3.7
5	3.4
6	3.1
7	3.0

8.6.1 The lowest standard must be of a concentration of one to five times the estimated LOD.

- 8.6.2 The maximum allowable LOD for each compound is 0.50 μg /mL ppbC. The calculated laboratory LOD must be equal to or lower than the maximum allowable LOD.
- 8.6.3 All peaks identified as target alcohols that are equal to or exceed the maximum allowable LOD must be reported.
- 8.6.4 If the calculated laboratory LOD is less than the maximum allowable LOD, the laboratory may choose to set its reporting limit at the maximum allowable LOD, the calculated laboratory LOD, or any level in between. Figure 5 shows a typical LOD determination.
- 8.6.5 The concentrations of the compounds below the reporting limit are considered to be zero.

8 References

- 9.1 "Characterization of Exhaust Emissions from Methanol and Gasoline Fueled Automobiles", EPA 460/3-82-004.
- 9.2 California Environmental Protection Agency, California Air Resources Board, "California Non-methane Organic Gas Test Procedures", May 31, 1996.
- 9.3 Code of Federal Regulations, Title 40, Part 86.

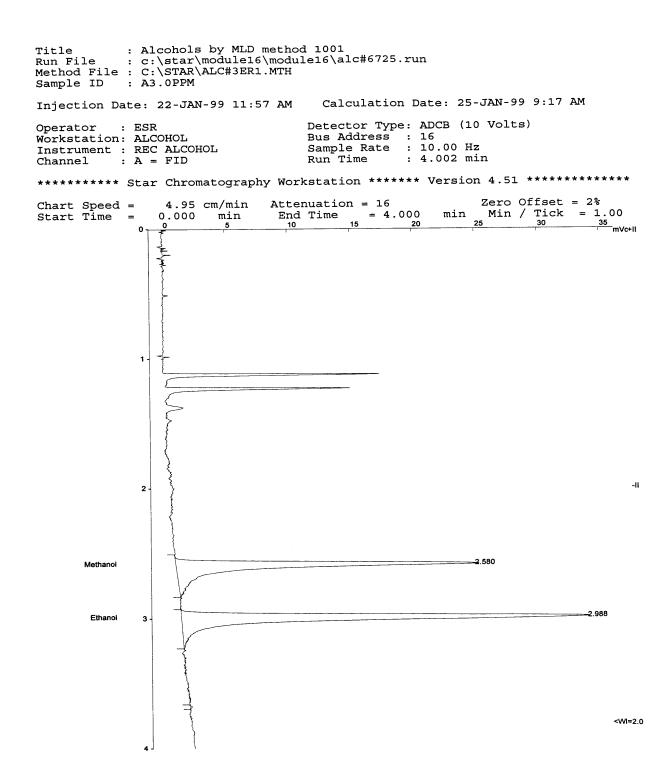


Figure 1. Calibration Standard Chromatogram

2nd QUARTER 2000 ALCOHOL QC REPORT ALCOHOL GC CONTROL DATA

METHANOL 1.5 UG/ML

ETHANOL 1.5 UG/ML

NO. OF	DATE OF	METHANOL	STATUS	VALID	AVE	STD	ETHANOL	STATUS	VALID	AVE	STD
RUNS	ANAL.	UG/ML		DATA		DEV	UG/ML		DATA		DEV
1	4/3/00	1.485	ок	1.485	1.505	0.0577	1.377	ок	1.377	1.490	0.0780
2	4/4/00	1.498	OK	1.498	1.505	0.0573	1.471	OK	1.471	1.490	0.0775
3	4/4/00	1.496	OK	1.496	1.505	0.0569	1.477	ОК	1.477	1.489	0.0769
4	4/4/00	1.526	ОК	1.526	1.505	0.0565	1.494	ОК	1.494	1.490	0.0764
5	4/4/00	1.556	ОК	1.556	1.506	0.0564	1.485	ок	1.485	1.489	0.0758
6	4/4/00	1.531	OK	1.531	1.506	0.0561	1.451	ОК	1.451	1.489	0.0754
7	4/7/00	1.568	OK	1.568	1.507	0.0562	1.438	OK	1.438	1.488	0.0751
8	4/7/00	1.520	ОК	1.520	1.507	0.0558	1.463	ОК	1.463	1.488	0.0747
9	4/7/00	1.584	ОК	1.584	1.508	0.0561	1.493	ОК	1.493	1.488	0.0742
10	4/7/00	1.578	ОК	1.578	1.509	0.0563	1.494	ОК	1.494	1.488	0.0737
11	4/7/00	1.576	OK	1.576	1.510	0.0565	1.494	OK	1.494	1.488	0.0732
12	4/7/00	1.667	WARNING	1.667	1.512	0.0589	1.602	OK	1.602	1.490	0.0738
13	4/14/00	1.440	ОК	1.440	1.511	0.0591	1.539	ОК	1.539	1.490	0.0736
14	4/14/00	1.345	WARNING	1.345	1.509	0.0617	1.473	ОК	1.473	1.490	0.0731
15	4/18/00	1.587	ОК	1.587	1.510	0.0619	1.412	ОК	1.412	1.489	0.0732
16	4/18/00	1.570	OK	1.570	1.511	0.0619	1.427	ОК	1.427	1.488	0.0731
17	4/18/00	1.561	ОК	1.561	1.512	0.0618	1.435	ОК	1.435	1.488	0.0728
18	4/18/00	1.625	OK	1.625	1.513	0.0626	1.474	ОК	1.474	1.487	0.0724
19	4/18/00	1.614	OK	1.614	1.514	0.0632	1.469	OK	1.469	1.487	0.0720

2ND QUARTER 2000 ALCOHOL QC REPORT ALCOHOL CONTROL STANDARD METHANOL = 1.50 UG/ML

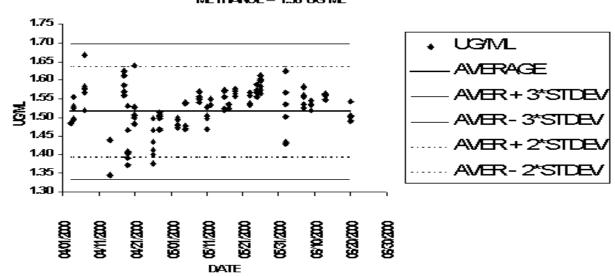


Figure 2. Typical Control Chart

2nd QUARTER 2000 ALCOHOL QC REPORT ALCOHOL REPLICATES

METHANOL LOD= 0.10 ETHANOL LOD= 0.10

NO. OF	DATE	SAMPLE	RUN	RUN	%RPD	MAX.	STATUS	RUN	RUN	%RPD	МАХ.	STATUS
RUNS		NO.	# 1	#2		%RPD		# 1	#2		%RPD	
1	4/3/00	131E1 D1A	3.924	3.836	2	20	ОК	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
2	4/4/00	131UC1 1A	0.409	0.380	7	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
3	4/4/00	128UC1 1A	0.304	0.278	9	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
4	4/4/00	131E D 1A	3.868	3.827	1	20	ок	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
5	4/7/00	138E H 1A	0.412	0.356	15	100	ОК	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
6	4/7/00	138C1B1A	0.536	0.551	3	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>OK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>OK</td></l<>	< L	OK
7	4/7/00	138E1 D BKG A	0.142	0.163	14	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
8	4/7/00	131E1 D 1A	4.112	4.087	1	20	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ΟK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ΟK</td></l<>	< L	ΟK
9	4/7/00	138E1 D 1A	1.785	1.822	2	30	OK	< L	0.104	<l< td=""><td>100</td><td>OK</td></l<>	100	OK
10	4/14/00	148C1B1A	0.655	0.684	4	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
11	4/18/00	148C1B 1A	0.773	0.765	1	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
12	4/18/00	148UC1B 1A	0.700	0.700	0	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
13	4/18/00	148E1 H 1A	0.398	0.452	13	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
14	4/18/00	148E1 D BKG A	0.089	0.095	6	< L	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
15	4/19/00	148E1 D BKG A	0.096	0.084	13	< L	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
16	4/19/00	148C1B 1A	0.673	0.698	4	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
17	4/19/00	148UC1 1A	0.597	0.603	1	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ОК</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ОК</td></l<>	< L	ОК
18	4/19/00	148E1 H 1A	0.352	0.354	1	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ΟK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ΟK</td></l<>	< L	ΟK
19	4/19/00	148E1 D 1A	1.719	1.751	2	30	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>OK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>OK</td></l<>	< L	OK
20	4/21/00	157E1 H 1A	0.241	0.240	0	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ΟK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ΟK</td></l<>	< L	ΟK
21	4/21/00	157C1B 1A	0.393	0.387	2	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ΟK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ΟK</td></l<>	< L	ΟK
22	4/21/00	157E1 D 1A	1.504	1.555	3	30	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ΟK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ΟK</td></l<>	< L	ΟK
23	4/26/00	157 UC1B 1A	0.331	0.317	4	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
24	4/26/00	161 UC1B 1A	0.487	0.484	1	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>ΟK</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>ΟK</td></l<>	< L	ΟK
25	4/26/00	161E1 H 1A	0.239	0.233	3	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
26	4/26/00	138C2B 1A	0.671	0.680	1	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
27	4/26/00	161E1 D 1A	0.949	0.942	1	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
28	4/28/00	165C1B1A	0.657	0.642	2	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
29	4/28/00	165E1 H 1A	0.162	0.160	1	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
30	4/28/00	138U1 1A	0.255	0.239	6	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
31	4/28/00	165E1 D 1A	0.929	0.935	1	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
32	5/3/00	169C1B1A	0.210	0.224	6	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
33	5/3/00	169E1 H 1A	2.055	2.065	0	20	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
3 4	5/3/00	169E1D 1A	5.877	5.885	0	15	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
35	5/3/00	165UC1 1A	0.153	0.139	10	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
36	5/5/00	161E2 H 1A	0.212	0.199	6	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
37	5/5/00	174C1B1A	0.739	0.754	2	100	OK	<l< td=""><td>< L</td><td><l< td=""><td>< L</td><td>O K</td></l<></td></l<>	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
38	5/5/00	175U1B 1A	0.283	0.285	1	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
39	5/9/00	161E2 D 1A	0.993	0.975	2	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K
40	5/9/00	175E1 H 1A	0.251	0.244	3	100	OK	< L	< L	<l< td=""><td>< L</td><td>O K</td></l<>	< L	O K

Figure 3. Duplicate Sample Report

Methanol Linearity 2/2/01

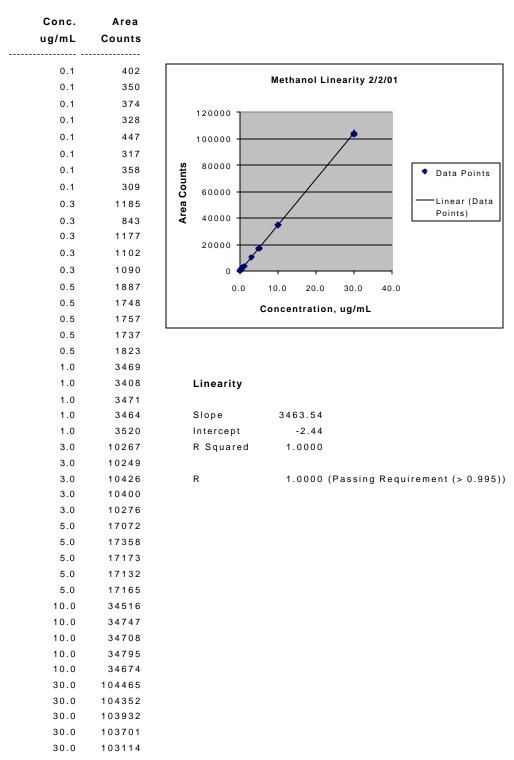


Figure 4. Multipoint Calibration

Methanol LOD 2/2/01

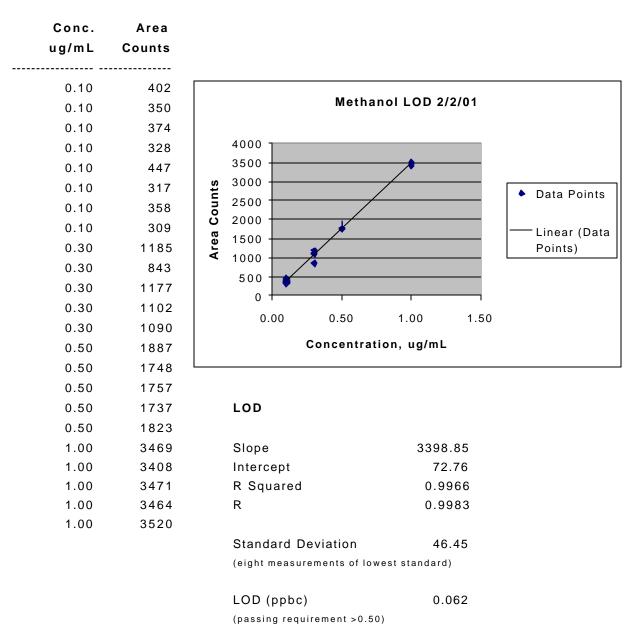


Figure 5. LOD Determination